TACTICAL TRAINING: ADVANCED WEAPON SYSTEM INFORMATION MANAGEMENT MISSION ANALYSIS (AWSIMMA)

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ABSTRACT

AWSIMMA (Advanced Weapon System Information Management Mission Analysis) is a proposed concept to record all the information transmitted over the data bus of military aircraft for post flight analysis as a feedback to improve mission effectiveness.

AWSIMMA will perform:

- (1) mission analysis using recorded time synchronized data for evaluating multiplatform performance relative to the Mission Planning profiles and data bases;
- (2) platform multi-sensor correlation to the data bases including evaluation of environmental effects and weapons capabilities;
- (3) operationally deployed training with stimulated processing functions to exercise realistic situational awareness;
- (4) data base evaluations, enhancement feedback and determination of requirements.

INTRODUCTION

The Naval Air Development Center is exploring the potential implementation, demonstration and evaluation of the AWSIMMA concept. This functional capability could support performance evaluations of the technology demonstrations such as the "Morning After" program.

PROBLEM

In order for the Battle Force to gain significant benefits from post time analysis, the entire sortie reconstruction needs to be performed in near real time. The problem of analyzing tactical aircraft performance on a sortie is compounded by the enormous amount of on-board real-time data being processed. Figure 1 represents the AWSIMMA application. It portrays multiple

platforms performing in accordance with the scenario developed by the Tactical Air Mission Planning System (TAMPS). A post time analysis of the recorded 1553 MUXbus for each platform will specifically identify when it performed each event and when sensors were applied or correlated with the TAMPS prepared data base. This would significantly benefit training and provide operational deployment feedback.

Future data busses will be of much higher speeds than the 1Mb/s 1553 bus. Data bus speeds of 50 to 100 Mb/s represent further technical challenge which will be addressed in order to record the data or selected portions for post time analysis. However the present 1553 bus provides a wealth of message communication between the platform mission computer and the various sensors/processors. Mission analysis of this data will ferret out actual performance, mission planning and data base functions, multi-platform interoperability tactics, Battle Force information management and modeling evaluations as well as provide brief/ de-brief training and data base enhancement feedback.

The AWSIMMA concept depicted in Figure 2 is based upon "state of the art" technology capabilities that will allow tactical information fusion.

APPROACH

The AWSIMMA approach is viewed as the feedback loop of a servo system, as depicted in Figure 3, with the servo input being the TAMPS. With data recording, the AWSIMMA feedback analysis performance evaluations of the aircraft processor system/equipment are accomplished, as well as the evaluation

of mission planning systems and capabilities. The essence of the evaluation capabilities lie in the navigation system performance, specifically the PVT (position, velocity and time) from GPS for scoring the mission profile. Processor performance algorithms to utilize TAMPs scenario prepared data bases such as DMA DTED and aircraft flight paths will use geophysical navigation, eg. terrain reference navigation (TRN), as well as TF/TA/ThA/OA capabilities that reflect mission accomplishment. Like a servo, the feedback analysis will aid in evaluating the performance process to drive new and improved tactics and processing algorithms as a damped servo follows its intended operation.

In Figure 3 the platform systems are represented as Processor, Mission Computer, Navigation, Communication, Sensor (Radar/FLIR), Digital Map (Spatial Processor), Weapon and ECM. Working in concert these systems perform the Tactical Mission as planned by the TAMPs and inputted into the platform prior to the mission. The recorded data are inputted into the DEPLOYED B System which can be located on board the carrier of a Battle Group to reduce and perform the mission analysis from Platform No.1, No. 2, No.3, ...NO. N as indicated. The resulting feedback provides the basis for improvements to the platform processing capabilities, pilot training etc., as well as feedback to the mission planning, TAMPs, and data base enhancements.

NEED

The need for a project focus to demonstrate the concept would be potentially satisfied by using AWSIMMA on the Nunn/Quayle Amendment supported "Morning After" (or similar) program. This would result in very cost effective evaluations that can be performed on both the AWSIMMA concept and the "Morning After" technologies via specific aircraft (F18).

The "Morning After" also leads to establishing interoperability, compatibility and performance evaluation standards capabilities with our Tri-Service and NATO partners. As interoperability issues are identified and evaluated, it also lays the ground work for Integrated Strike Planning System (ISPS), performance requirements and deployed Battle Force model performance evaluations. This evaluation need not be limited to specific canned test ranges,

such as Fallon, but can allow fleet pilots, while deployed in distant areas such as the Indian Ocean or South Pacific, to perform advanced tactical training and evaluations without test range restrictions. Further, the AWSIMMA tactical fusion processor provides the key element for post time analysis of fleet exercises drawing close ties with the laboratory community.

IMPLEMENTATION

Figure 4 represents the AWSIMMA, overall implementation approach. This concept incorporates the prototype development, evaluation, validation, deployment, operational mission analysis, incremental enhancement and feedback. R&D funding focus is on 6.2/6.3 during the prototype development. However for deployed assets the improvements can reflect developments covered under O&MN funding.

New warfare capabilities / enhancements can be easily accomplished because the modular architecture will be primarily ADA software upgrades which reflect Fleet capability as derived by the feedback loop analysis. It is to be noted that advanced training technologies are planned to be employed utilizing functional in-flight stimulations of sensor/ parameters relative to pilot realistic situational awareness training and platform processing that will enhance and develop the next mission capabilities and tactics. Measures of Effectiveness, MOE, are quantitative values based upon measurable performance factors.

NAVY UNIQUE MISSIONS

In addition to the "Morning After" attack/strike focus, other potential Navy mission areas should be explored as the AWSIMMA capability is demonstrated. These include ASW, MCM, Amphibious and Survey, etc. The AWSIMMA system can integrate various spatially related data bases, for a very cost effective performance analysis and evaluation of mission planning, data bases, equipment and systems. Figure 5 indicates the AWSIMMA Tactical Fusion Processor potential for Battle Force Information Management which ultimately is on-line real time processing.

MC&G / E³ DATA BASES

How weapon systems perform relative to MC&G/E3 (Mapping Charting & Geodesy / Electromagnetic & Environmental Effects) parameters is a serious concern which is being pursued. With the AWSIMMA approach, potential correlations of actual sensor/ equipment/ system/ weapons performance relative to the various MC&G/E3 data bases and parameters, as indicated in Table 1, can be derived. AWSIMMA provides the basis to extract data from sensors or the mission systems associated with time synchronized accurate spatial positional information from GPS, to perform possible correlations. For example mission performance or restrictions could possibly be correlated to cloud, rain, haze, temperatures, RF ducting etc. which might establish new data base requirements and/or tactics based upon the proper information management of these quantities. It is to be noted that the correlation and utilization of MC&G products provide a common datum and source of non-deniable accurate geophysical navigation that with the advent of GPS will cause increased need for data base accuracy, resolution and sensor correlation capabilities. Virtually all platforms will have GPS. GPS particularly in a peace time environment, on-board these platforms, allows each platform to have certified survey accuracy navigation capability, which should be exploited to confirm and enhance the available data base and augment the DMA archival data gathering capability. Future overt/ covert Naval missions, will depend upon this non-deniable asset. Geophysical navigation such as Terrain Reference Navigation, TRN, as well as sensor/data base correlation to perform TF/TA/ThA/OA/etc. and sensor management functions could possibly be performed in the absence of external NAVAIDS utilizing the data bases with a sense of confidence or deja vu. The data bases represent prestored sensor measurements to aid in performing on-board sensor correlation processing for mission accomplishment.

CONCLUSION

In the past the use of data bases such as MC&G/E3 with platforms, mission planning systems or missile systems has been developed with a static data base mindset. The data base was considered a support function and not primary to the success of the weapon/ mission. With the development of new computer and communications architectures, data bases, when properly integrated into a servo loop relationship, new and unthought of

warfighting capabilities will emerge. Under this new premise, data base developers and system integrators are a equal part of the entire weapon system engineering development process. From the initial concept through advanced enhancements and on-line operational support, the data base is considered to represent pre-stored sensor data which is critical to automatic geophysical correlation processing functions needed to perform future missions.

SUMMARY

The proposed AWSIMMA concept provides an overall approach which focuses on the use of GPS to perform evaluations of mission analysis as well as MC&G/E3 data bases. The information management mission analysis will improve mission planning functions and capabilities. It will mature the platform sensor geophysical correlation functions with the data bases. A complete multi-platform real time Advanced Weapon System Information Management will evolve capable of supporting overt/covert missions under severe conditions. AWSIMMA allows TAMPS/ISPS data base evaluations/enhancements and incremental improvements to the entire Battle Force. AWSIMMA addresses standards, Tri-Service/Allied interoperability, training and maintainance of assets.

TABLE 1

METEOROLOGY PARAMETERS

Barometric Pressure
Cloud Cover
Cloud Type
Density
Dew Point
Dust/Sand
Electromagnetic Radiation
Fog/Mist
Ionospheric Effects
Infrared Detection Ranges
Laser Parameters
Lightning
Platform Icing
Precipitation
Reflectivity
Refraction Ducting
Relative Humidity Profile
Sea Clutter
Significant Weather Phenomena
Snow
Solar Radiation
Sun Spot Number
Temperature Profile

TABLE 1 (CON'T)

Turbulence
 Visibility
 Water Vapor
 Wind Speed and Direction
 Wind Shear

OCEANOGRAPHY PARAMETERS

Absorption
 Ambient Noise
 Biologies
 Bioluminescence
 Bottom Loss
 Currents
 Density Structure
 Depths
 Dielectric Constant
 Dissolved Gases
 Ice
 Internal Waves
 Mixed Layer Depth
 Ocean Fronts and Eddies
 Performance Prediction Model
 Propagation Model
 Salinity
 Sea Surface Temperature
 Sound Velocity
 Surf

Surface Conductivity
 Surface Scattering/Reverberation
 Temperature Profile
 Thermocline
 Turbulence
 Volume Scattering/Reverberation
 Water Clarity
 Waves

M C & G PARAMETERS

Bathymetry
 Bottom Contours
 Bottom Morphology
 Digital Bathymetry
 Digital Features Analysis Data
 Digital Maps/Charts
 Digital Shoreline
 Digital Terrain Elevation Data
 Ephemeris Parameters
 Geodetic Data
 Gravity
 Imagery
 Magnetism
 Map/Chart Products
 Precise Time
 Shipwreck File
 Vertical Obstruction File

Figure 1

AWSIMMA TACTICAL APPLICATION
 Sortie Reconstruction of Single Aircraft
 of Entire Airwing

Fig 2
Concept of Operation

Fig 3
Feedback Hoop

Fig 4
Implementation

Figure 5
AWSIMMA TACTICAL FUSION PROCESS